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now unknown to us. The presence of the bright iron lines $\lambda 4202$, $\lambda 4308$, and $\lambda 4376$, the absence of others of the same element, and the diversity of structure observed by CAMPBELL in the triple $H\gamma$ and $H\delta$ bands are perhaps due to similar unknown causes.

The great variations of relative intensity observed in the hydrogen and other bright lines, and in the continuous spectrum, show that the star's decrease in light is produced by other causes than general absorption.

Considering all the evidence, it seems reasonably certain that the star's variation in brightness is due to the action of internal forces.

I beg to acknowledge my indebtedness to Director CAMPBELL, who provided the necessary apparatus and made valuable suggestions during the course of the work; to Messrs. WRIGHT and REESE, for continual advice and assistance; and to Dr. H. D. CURTIS, for enlarging the negatives for reproduction.

May 1, 1903.

NOTES ON VARIABLE STARS.

BY ROSE O'HALLORAN.

Y Cassiopeæ.

The variation of this star, which was discovered on the photographic plates of Harvard College Observatory a few years ago, ranges from 9.8 to 13th magnitude.

According to the comparison-stars of 10.2 and 12th magnitude close above, it was of 11.3 magnitude on the 1st and 2d of August, in 1902, and on October 26th and 31st, and November 3d it had increased to 11th magnitude.

W Aurigæ.

Having become invisible in last December, the predicted maximum was looked for towards the middle of January of this year.

On the 14th, 17th, and 27th, and on February 1st it was still invisible, though a comparison-star of 12th magnitude was seen. The period of *W. Aurigæ* seems to be irregular.

S S Cygni.

This fitful variable was nearly equal to *b* of 8.5 magnitude recently, but has since declined.

1903. June 23, 8:50 P. M.—Two tenths less than *b*. June 24, 25, 26—Decreased, but still brighter than *a* of 9.5 magnitude. June 27, 29—Equal to *a*. June 30, 9:17 P. M.—Slightly less than *a*, but distinctly brighter than *d* of 10.5 magnitude. July 1—Between *a* and *d*, but nearer to *d*. July 2—Dimmer in haze and moonlight; *d* not seen. July 3—Barely discerned in haze and moonlight. July 4, 5—Equal to *d* in hazy moonlight. July 6—Less than *d*, clear moonlight.

W Lyræ.

The recent increase and decline of this star was observed as follows:—

1903. February 21—8.8 magnitude; not equal to *a*; equal to *e*. February 28—8.6 magnitude; brighter than *e*, equal to *a*, less than *n*. Morning clear. March 6, 9, 18, 22—Still equal to *a*. Mornings rather clear. March 25—8.7 magnitude; slightly decreased. April 3—8.8 magnitude. April 11—9th magnitude, according to the comparison-stars. April 22—9.8 magnitude. May 1—10.5 magnitude. May 12—11th magnitude. June 1st—About 12th magnitude; barely visible. June 17, 22, 25, 29—Not visible. July 1, 2, 3—Not visible. July 6—In clear moonlight not visible with a high power.

Classified comparison-stars not being available for the following variables, namely, *W Cassiopeæ*, *V Coronæ*, and *V Hydræ*, the estimates are founded only on experienced observations. Except in the case of *V Hydræ*, the comparison-stars used were closely adjacent to the variables.

W Cassiopeæ.

1902. August 22—11.5 magnitude. September 25, 27—Invisible. October 26, 28, 31—Invisible. November 3—Invisible.

1903. June 24, 26, 29, 30—Of 10th magnitude. July 1, 2, 3—Of 10th magnitude.

V Coronæ.

1903. April 22—Somewhat less bright than 9th magnitude. May 1—Distinctly brighter, compared to the stars closely adjacent. It was of about 8.5 magnitude.

V Hydræ.

1903. February 4—Less than B^2 of 6th magnitude, but visible in an opera-glass, and probably of 6.7 magnitude. February 12—6.7 magnitude. Moonlight. This is the date of expected maximum. February 19, 23, 25, 26—6.7 magnitude. March 3, 6, 16—6.7 magnitude. April 1—Slightly decreased in telescope and still more decreased in opera-glass. April 11, 16—Ditto. April 26—Of about 7th magnitude, but still visible in opera-glass.

SAN FRANCISCO, July 7, 1903.

PLANETARY PHENOMENA FOR SEPTEMBER AND
OCTOBER, 1903.

BY MALCOLM MCNEILL.

PHASES OF THE MOON, PACIFIC TIME.

Full Moon, Sept. 6, 4 ^h 20 ^m P.M.	Full Moon, Oct. 6, 7 ^h 24 ^m A.M.
Last Quarter, " 14, 5 14 A.M.	Last Quarter, " 13, 11 56 A.M.
New Moon, " 20, 8 31 P.M.	New Moon, " 20, 7 30 A.M.
First Quarter, " 28, 5 8 A.M.	First Quarter, " 28, 12 32 A.M.

The Sun reaches the equinox and autumn begins September 23d, 10 P. M., Pacific time.

There will be a total eclipse of the Sun on September 20th, but it will not be available for astronomical observations, as the path of totality lies in the most inaccessible region of the globe. It begins in the Indian Ocean, southeast of Africa, and runs eastward and then southward, ending near the South Pole. There is very little land from which even the partial phase of the eclipse can be seen; Madagascar and the southern portions of Australia and New Zealand are about all.

There will also be a partial eclipse of the Moon on October 6th, rather uninteresting to people in the United States, since no part of it will be visible here. It will be visible throughout most of the eastern hemisphere and will be not quite total.

Mercury begins the month as an evening star, coming to greatest east elongation on September 7th. It is then 27° from